

**RECOMMENDED TECHNICAL AMENDMENTS TO
EPA TIER 0/1/2 LOCOMOTIVE RULE
October 2003**

Reference	Current Regulatory Language	Recommended Regulatory Language	Comment/Reason
<i>Editorial Changes</i>			
92.2(b)	<i>Repower</i> means....such that less than 25 of the parts of the locomotive were previously used (as weighted by dollar value) is not repowering.	<i>Repower</i> means....such that less than <u>25 percent</u> of the parts of the locomotive were previously used (as weighted by dollar value) is not repowering.	Presumably reference should be to percent, not number, of parts
92.123(a)(2)(ii)	(ii) None of the measured opacity values for the stack tested are not greater than three-quarters of the level allowed by any of the applicable smoke standards.	(ii) None of the measured opacity values for the stack tested are greater than . . .	The double negative in the current regulatory language would seem to disallow locomotives with clean stacks.
92.132(d)	Equation $K_H = \frac{[C_1 + C_2(\exp((-0.0143)(10.714))]}{[C_1 + C_2(\exp((-0.0143)(1000H))]}$	Equation $K_H = \frac{[C_1 + C_2(\exp((-0.0143)(10.714))]}{[C_1 + C_2(\exp((-0.0143)(1000H))]}$	Unbalanced parentheses in equation
92.203(d)(1)(i)	...the engine family specifications, the provisions of which are contained in §92.208	...the engine family specifications, the provisions of which are contained in §92.204	Incorrect section reference
92.208(a) and (b)	...The certificate of conformity is valid...until 31 December of the model year or calendar year <u>in</u> which it is issued....	...The certificate of conformity is valid...until 31 December of the model year or calendar year <u>for</u> which it is issued....	As currently written, certificate issued in 2003 for 2004 engine family would expire 31 December 2003
92.212(c)(2)(v)(D)(2)	Label stating applicable to locomotives and locomotive engines originally manufactured on or after January 1, 2002, and remanufactured after January 1, 2005	Label stating applicable to locomotives and locomotive engines originally manufactured on or after January 1, 2002, and prior to January 1, 2005	Paragraph should describe label for Tier 1 locomotives and engines manufactured in 2002, 2003, and 2004

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<i>Substantive Changes</i>			
92.1103— Prohibited acts	(a)The following acts and the causing thereof are prohibited: (1)(i)(A) In the case of a manufacturer or remanufacturer of new locomotives or new locomotive engines, the sale, the offering for sale, the introduction into commerce, the delivery for introduction into commerce, or the distribution in commerce of any new locomotive or new locomotive engine manufactured or remanufactured after the effective date of applicable emission standards under this part, unless such locomotive or locomotive engine is covered by a certificate of conformity issued (and in effect) under regulations found in this part.	(a)The following acts and the causing thereof are prohibited: (1)(i)(A) In the case of a manufacturer or remanufacturer of new locomotives or new locomotive engines, the transfer of equitable title to an ultimate purchaser, or the placing into service of any new locomotive or new locomotive engine manufactured or remanufactured after the effective date of applicable emission standards under this part, unless such locomotive or locomotive engine is covered by a certificate of conformity issued (and in effect) under regulations found in this part.	Locomotives are, in effect, offered for sale at the start of the order negotiation. Recommended change would recognize non-emissions-related business practices of manufacturers or owner-operators.
92.1103 (a)(4)(i)	To sell, offer for sale, or introduce or deliver for introduction into commerce, a new locomotive or new locomotive engine unless the manufacturer or remanufacturer has complied with the requirements of §92.1107	To transfer equitable title to an ultimate purchaser, or place into service, a new locomotive or new locomotive engine unless the manufacturer or remanufacturer has complied with the requirements of §92.1107	Same as above
92.1103(a)(4)(ii)	To sell, offer for sale, or introduce or deliver for introduction into commerce, a new locomotive or new locomotive engine unless all required labels and tags are affixed to the engine in accordance with §92.212	To transfer equitable title to an ultimate purchaser, or place into service, a new locomotive or new locomotive engine unless all required labels and tags are affixed to the engine in accordance with §92.212	Same as above

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92.1103(a)(5)	For a manufacturer or remanufacturer of locomotives to distribute in commerce, sell, offer for sale, or deliver for introduction into commerce new locomotives (including all locomotives which contain a new engine) not covered by a certificate of conformity	For a manufacturer or remanufacturer of locomotives to transfer equitable title to an ultimate purchaser, or place into service new locomotives (including all locomotives which contain a new engine) not covered by a certificate of conformity	Same as above
92.2— Definition of “Remanufacture”	<i>Remanufacture</i> means: (1)(i) To replace, or inspect and qualify, each and every power assembly of a locomotive or locomotive engine, whether during a single manufacture or cumulatively within a five year period;...	Options: -Exempt 5-year cumulative locomotives from in-use testing -Allow replacement of power assembly over $\frac{3}{4}$ UL (with break-in) prior to in-use testing -Allow certificate holders to require full power assembly overhaul at time of remanufacture	Current provisions imposes undue burden on certificate holder, because makes responsible for in-use emissions performance of locomotive with power assemblies up to useful life + 5 years old
92.8(b)—Emission standards	No discharge of crankcase emissions into ambient atmosphere; discharge into exhaust complies, provided emissions are measured and included with exhaust emissions	No discharge of crankcase emissions into ambient atmosphere; if discharge into ambient atmosphere, must measure and include with exhaust emissions [Ref. 40 CFR 94.8(d)]	Locomotive requirement should parallel marine requirement, as many of engines are similar.
92.113—Fuel specifications	Total sulfur, pct.....0.2-0.4	Reflect adoption of certification fuel sulfur content recommendations in EMA 20 August 2003 comments to 40 CFR 89 NPRM.	Certification fuel sulfur content should follow that likely to be in use on the railroads.
92.132 (d)—Calculations	Current NO _x correction factor devalues correction in some cases ($\pm 25\%$) and allows no correction in other cases	Revise NO _x correction factor to be consistent with 40 CFR Part 86	Adjustment in NO _x correction factor required to account for effects of humidity and temperature; SwRI data indicates Part 86 equations predict locomotive behavior quite closely.

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92.132	<p>Per the rule, K_T for tests run at ambient temperature at or above 86°F is 1. Using the default values for T_A and T_{30} provided (ambient temperature and 100°C, respectively), K_T at 86°F is –5.26 using 0.017 factor and 3.98 using the 0.0107 factor. So the K_T equation fails to provide smooth transition between region above and below 86°F.*</p> <p><i>Related editorial change:</i> $K_T = 1/[1-0.017(T_{30} - T_A)]$</p>	<p>Default values should be corrected.</p> <p>$K_T = 1/[1-0.0107(T_{30} - T_A)]$</p>	<p>K_T equation is incorrectly transcribed from SwRI 12/15/1997 letter.</p>
92.132(e)	Calculations other than those specified in this section may be used with the advance approval of the Administrator		Specific criteria for development and approval of alternate correction factors proposed by EPA Test Procedure Subcommittee should be reviewed and adopted by EPA
92.132(d)	Correction factors based on manifold temperature	Correction factors based on ambient temperature	Current provisions requires determining correlation between ambient temperature and manifold temperature, which requires close control of temperatures and is difficult

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92.212 (a); 92.307 (ABT)— Labeling	Each new locomotive and new locomotive engine ... shall be labeled...; ..the FEL to which the locomotive or locomotive engine is certified must be included on the label required in 92.212	Elimination of dual labeling requirement; label only the engine or locomotive	Current provision: -Creates manufacturing complexity at change of years, because engine and locomotive labels must match (first character in label [?]) -Requires carryover of every certificate for every year forever in order to be able to build a “service part” engine
92.212(b)(2)(v)(A) and 92.212(c)(2)(v)(A)	Current regulatory language makes engine and locomotive labels very similar, but not identical. This has caused problems with remanufacture system applications in the field.	92.212(b)(2)(v)(A): The label heading: Locomotive Emission Control Information. 92.212(c)(2)(v)(A): The label heading: Engine Emission Control Information	Change would make an obvious difference between locomotive and engine labels other than part numbers or subtle text difference (the only current difference is contained in subparagraph (2)(v)(D)(1-3) of the respective paragraphs). Alternative: Change labels so that the information and phraseology required is identical in all respects.
92.104(b)(1)(i) – Speed and load tolerances	Engine speed and load for each mode shall be within 2 percent of the speed and load of the engine when it is operated in the locomotive.		Specified tolerance is too tight and not realistic for “unloaded” notches (0.16, 0.28, and 0.32 hp respectively for low idle, high idle and dynamic brake)
92.105(d)— Electrical measurements	(1)-(3): Voltmeters, ammeters, and wattmeters shall have accuracy and precision of 1 percent of point or better	Eliminate accuracy requirements for individual pieces of electrical equipment; require only that equipment used in power measurement should be of sufficient accuracy to insure that overall power measurement accuracy requirements are met.	The devices will not be able to meet these requirements at low power levels where operator may be measuring less than 10 mV (or 1mV). Test procedures already specify accuracy requirements for power measurement at each notch. EPA agreed to eliminate 92.105(d) at Feb 17-18, 1998 meeting.

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92.106(b) – Torque measurement	(1)(ii) Engine flywheel torque readout shall be accurate to either within ± 3 percent of the NIST “true” value torque, or the following accuracies, whichever provides the most accurate readout: (A) ± 20 ft-lbs of the NIST “true” value if the full scale value is 9000 ft-lbs or less; or (B) ± 30 ft-lbs of the NIST “true” value if the full scale value is greater than 9000 ft-lbs.	(ii) Engine flywheel torque readout shall be accurate to within ± 2 percent of the NIST "true" value torque at all power settings above 10 percent of full-scale. Below 10 percent of full-scale, the accuracy shall be within ± 5 percent of the NIST "true" value torque.	Tolerance is too tight at high torque values. Torque values on 6000-hp engine can exceed 30,000 ft-lbs. The ± 30 ft-lbs requirement would require accuracy of better than 0.1%. Recommended language mirrors that in part 86 (86.312-79).

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92.107(a)(1) – Fuel flow measurement; 92.126(b)(3) – Test run	<p>(1) The fuel flow rate measurement instrument must have a minimum accuracy of ± 2 percent of measurement flow rate for each measurement range used. An exception is allowed at idle where the minimum accuracy is ± 10 percent of measured flow rate for each measurement range used. The measurement instrument must be able to comply with this requirement with an averaging time of one minute or less, except for idle, dynamic brake, and notches 1 and 2 where the instrument must be able to comply with this requirement with an averaging time of three minutes or less. * * *</p> <p>(3) Fuel flow rate shall be measured continuously. The value reported for the fuel flow rate shall be a one-minute average of the instantaneous fuel flow measurements taken during the last minute of the minimum sampling period listed in Table B124-1; except for testing during idle modes, where it shall be a three-minute average of the instantaneous fuel flow measurements taken during the last three minutes of the minimum sampling period listed in Table B124-1. Sampling periods greater than one minute, but no greater than three minutes are allowed for modes 2, 3, and 4, where required by good engineering practice.</p>	<p>(1) The fuel flow rate measurement instrument must have a minimum accuracy of ± 2 percent of point. An exception is allowed at idle where the minimum accuracy is ± 10 percent of point. * * *</p> <p>(3) Fuel flow rate shall be measured continuously. The value reported for the fuel flow rate shall be an average of the stabilized fuel flow measurements taken during the mode.</p>	Important requirement is accuracy; no need to specify averaging time as long as the accuracy requirements can be achieved in the mode test time. Fuel scale instrumentation currently used by manufacturers will require longer averaging time than that allowed, especially at lower notches where fuel rates are low.
92.114(a)(2)(ii) – Sampling system	For locomotive testing where the locomotive has multiple exhaust stacks, proportional samples may be collected from each exhaust outlet instead of ducting the exhaust stacks	For locomotive testing where the locomotive has multiple exhaust stacks, proportional samples may be collected from each exhaust outlet instead of ducting the exhaust stacks	Large amount of testing must be done to determine if proportional sampling can replace ducting stacks together. EPA indicated it would accept EMA's proposal to limit comparative testing

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	together, provided that the CO ² concentrations in each exhaust stream are shown (either prior to testing or during testing) to be within 5 percent of each other for each test mode.	together, provided that the CO ² concentrations in each exhaust stream are shown at Notch 8 (either prior to testing or during testing) to be within 5 percent of each other.	to Notch 8
92.114(d)(2) – Exhaust backpressure	...The exhaust backpressure for engine testing shall be set between 90 and 100 percent of the maximum backpressure that will result with the exhaust systems of the locomotives in which the engine will be used....		Specified tolerance is too tight and not realistic for medium-speed engines.
92.124(a)(2) – Ambient temperature for testing	...between 45°F (7°C) and 105°F (41° C) throughout the test sequence. Manufacturers may test at higher temperatures...but no corrections are allowed	...between 45°F (7°C) and 105°F (41° C) throughout the test sequence. Manufacturers may not test at higher or lower temperatures.	Testing outside specified temperature window would increase changes for inaccurate and/or non-reproducible data; exposes manufacturer to additional risk of failing an emissions test with a conforming engine; change was agreed to by EPA at Feb. 17-18, 1998 meeting with EMA
92.124(f); Table B124-1—Test sequence	Lowest idle.....15 min maximum	Lowest idle.....15 min. maximum after engine drops to lowest idle speed	Many locomotives will not allow lowest idle speed until temperature has fallen to a certain value
92.125 – Steady state measurements	Requirement for averaging of data over last one minute of a test run and (b)(6) requirement to establish that the temperature of the intake air...at each test point, is within ±5°F of temperatures in locomotive operations at the ambient temperature represented by the test prior to sampling	Allow averaging of data over last 1 to 4 minutes of a test run	Current time interval is too short to achieve steady state and to meet (b)(6) requirement
92.130 – Steady state concentrations	Measurement and calculation of time-weighted integrated concentrations		Measurement criteria are overly complex and burdensome, without discernible emissions benefit and need to be simplified; visual evaluation

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			provision is helpful but not enough
92.131—Smoke, data Analysis	(b)(3) The highest reading occurring more than two minutes after the notch change (excluding peaks lasting less than 5 seconds, caused by such random events as the cycling of an air compressor) is the “steady-state” value	(b)(3) The average of the second by second values between 120 and 180 seconds after the notch change (excluding peaks lasting less than 5 seconds, caused by such random events as the cycling of an air compressor) is the “steady-state” value	“Steady-state” means average opacity once some equilibrium is obtained, not a peak reading. Other sections of rule adequately monitor highest opacity readings (“3-second peak” and “30-second peak”); change previously agreed to by EPA at Feb 17-18, 1998 meeting
<i>Potential Future Resolution</i>			
N/A	Replacement engines not treated	Need provision under which a replacement engine for a certified locomotive can be built	Currently there is no good way for a manufacturer to build, for instance, a replacement engine in 2005 for a 2002 Tier 1 locomotive. How would such an engine be certified? If it’s certified to Tier 1, would it require credit use to sell in 2005? It should not.
92.8 (and related sections throughout)	Standards measured in grams/brake-horsepower-hour (g/bhp-hr)	Standards measured in grams/net traction horsepower, with adjustment of standard values for equal emissions per work done.	Postponed – maybe Tier 3-4 issue Net traction hp basis would allow simple measurement of main alternator volts and amperes without accessory power measurement and alternator efficiency measurement. Consistent with net traction specific basis of fuel consumption. Facilitate testing required of railroads in 2005.